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AUTHOR Kirley, Jacqueline P.
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ABSTRACT

The extent of variety in structure and format of teaching mathematics in fifth grade classrooms and its relation to student attention was studied. The data for this study consisted of observations made in eighteen math classes for a period of six to ten days with a mean of over eight days. Seatwork and recitation accounted for over 95 percent of student-minutes, which indicated that little variety existed in mathematics instruction in the observed math classes. Socioeconomic status and level of expenditure were related to attention span, but did not influence the mean number of instructional segments per day. It was concluded that, in teaching a skills-oriented course to fifth grade children, variety of instructional procedures is not an important variable in accounting for student attention. Variety of procedure enhances student attention only if there is sufficient time in the class period to allow for more segments. If there is not, it detracts from attention. It was observed that on days with more segments than usual, attention increased somewhat, and a less frequently-used instructional format brought higher attention levels than the class' more frequently-used format. (JD)

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Variety of Procedures and Its Effects in Skills-Oriented, Fifth Grade Classrooms

by

Jacqueline P. Kirley

Paper presented at the Annual Meeting of the AERA, Los Angeles, April, 1981

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I. INTRODUCTION

> Variety in method of presentation has been commonly suggested as a means of gaining and holding attention. [I]t is a rare teacher of elementary education who has not learned both in theory and in practice that variety is the environmental characteristic so necessary to cope with the abbreviated attention span of pupils at the elementary level.
>
> (Anthony, 1967, p. 60)

This idea, while it has considerable public support and gets occasional nods in the literature such as the quotation above, has in fact scarcely been considered in the literature and, where it has, the relation between variety and attention has not always been positive. This paper addresses itself to the issue of what constitues a variety of procedures in a classroom and whether such variety is related to student attention.

The issue falls in an area where two bodies of literature intersect: the ecological literature, which describes classroom structure, interrelating physical setting, resources, teacher and student behaviors, and the literature which concerns itself with student time-on-task, also a concern of some ecologists. This paper will review only literature dealing with variety. However, since the literature is sparse, the review will encompass all forms of variety, not just procedural variety. In addition, it will discuss studies which correlate variety with student achievement. Enough evidence exists showing a relationship between student attention and achievement (see Fisher, Berliner et al., 1980 and Borg, 1980) that we may infer that in those studies which found a relationship between variety and achievement, there might also be a relation between variety and attention.

II. REVIEW OF THE LITERATURE

Kounin's work (1970) takes precedence in the literature. It includes four separate studies on the managerial behaviors teachers use to encourage work involvement and reduce deviancy in students. One of these behaviors was "programming for learning-related variety." The relation he found between this variable and work involvement interacted with grade level and setting.

In the first study he correlated lengths of academic sessions (all sessions, recitation sessions, and seatwork sessions) with work involvement and freedom from deviancy. The correlations were on the order of zero. Next, over half a school day he coded each classroom activity on eight characteristics and correlated variation between one activity and the succeeding one with student behavior. He found no significant positive correlation. In fact, 40% of the 64 correlations were negative with three of them significant at the .05 level. Third, Kounin and his associates rescored for variation between temporally adjacent activites using only school-unique activities--"those activites that most children would perceive as concerned with learning or skill development (reading, arithmetic, science, social studies, etc.). These activities were considered to be either in recitation or seatwork settings." (Kounin, 1970, p. 137) This time he got only a few negative correlations and the rest positive, but the only significant positive correlations were in grades 1 and 2 and in seatwork settings. Finally, he analyzed only seatwork settings and found variety signficantly and positively correlated with work involvement and freedom from deviancy in grades 1 and 2, but negatively correlated for grades 3 through 5. Kounin hypothesized that "felt progress in learning is a more important antisatiation factor for the older children" while "experienced variety may be relatively more salient for the younger children." (Kounin, 1970, p. 138)

Some tangential evidence supporting the relation between variety and

attention comes from Wild and Edson (1967) who found that when student teachers employed a variety of procedures and a greater variety of teaching materials, disruptive behavior occurred less frequently.

After studying teacher strategies and student engagement, Hess and Takanishi-Knowles (1973) concluded that neither specific strategies (such as moving, changing activity, showing animation, offering challenges, and summarizing) nor the number of them which were used made a difference in student engagement. What did matter were more molar features of the instructional environment such as percent use of dyadic or small group instruction. The latter correlated with overall percentage of engagement for the 24 teachers significantly at $p < .05$ using a Spearman rank order correlation. This change in instructional environment would be considered a change in instructional procedure and hence lends support to the idea that greater variety in instructional procedure is positively correlated to student attention.

The remainder of the literature review discusses studies which relate variety to achievement. Rosenshine and Furst (1971) abstracted eleven variables with the strongest relation to student achievement from 50 process-product studies and of the five variables with the best results, "variability" was the fourth. They cite eight studies: three deal with variety of resources, two with variety of cognitive levels of discourse, one with a number of types of variety (instructional procedures, test forms, displays, materials), and two, by their description, deal with teacher flexibility, which Rosenshine and Furst later claim to be distinct from variety. They conclude that "Both high-inference and low-inference correlational studies have indicated that student achievement is positively related to classrooms where a variety of instructional procedures and materials is provided, and where the teacher varies the cognitive level of discourse and of students' tasks." (p. 45)

The conclusion is not that obvious. One study they cite (Lea, 1964) found the variety of total numbers of materials used in social studies lessons correlated positively with pupils showing higher mean gain on reading comprehension and language arts, but there was no relation to pupils' performances on reading vocabulary and work study skills--a rather limited relation.

Another study, Solomon et al. (1963), created factors from material gathered from student questionnaires, tape analysis, observers' rating scales, and teacher questionnaires. The first of eight factors, Permissiveness vs. Control, had flexibility as the 14th of 27 items with a positive loading of over +.40. The factor correlated -0.19 with student factual gain and -0.32 with comprehension gain. If teachers were split into high, moderate, and low on that factor, then the teachers who were classified moderate had students with greatest gains in comprehension. By no means do these results clearly show a positive relation between variety and achievement.

Even if we accept Rosenshine's and Furst's conclusion, it must be tempered by McDonald's report (1977) on The Beginning Teacher Evaluation Study, Phase II, which suggests that variation in instructional procedures, materials, and so on should be considered in the context of the subject matter and grade being taught. For instance, variety of instructional materials is a positive predictor of pupil performance in Grade 2 reading but a negative predictor in Grade 5 reading and Grade 2 mathematics. Some variables such as variety of instructional techniques are positive predictors for Grade 5 reading and mathematics but do not show a relation with either subject in Grade 2. McDonald concludes that the appropriate pattern for organizing instruction differs by subject matter and grade level.

A separate issue is whether teacher flexibility should be considered a part of variability. Rosenshine and Furst conclude it is a distinct variable because in recent studies it has been identified by counting any

kind of variation in teacher behavior rather than changes of particular kinds. Of ten studies they cite, only two yield any significant results.

One study not reviewed by them defined flexibility more narrowly and can perhaps be included in a review of variability. Flanders (1965) identified two types of teacher influence: indirect (accepts feelings, praises or encourages, accepts or uses ideas of student, and asks questions) and direct (lecturing, giving directions, and criticizing or justifying authority). Flanders writes that the "... students who achieved the most... were in classes which were exposed to flexible patterns of teacher influence. This flexible pattern included periods of predominantly direct influence as well as periods of predominantly indirect influence." (p. 110) Since different patterns of teacher influence correspond to different classroom procedures, this study, too, may support the idea that variety in classroom structure is associated with student achievement.

What generalizations can we make from this review about the effects of variety in the classroom?

First of all, variety applies to a multitude of variables. In the study in which variability is found to be the fourth strongest variable in relation to achievement, it included variety in instructional procedures, cognitive levels, test forms, materials, and displays, making "variability" really a cluster of variables.

Second, the positive results of the studies linking variety of instructional procedures with achievement in higher grades of elementary school do not conform to Kounin's results on 5th grade children. A possible reason for this might be that Kounin looked at variation within seatwork settings or between sequential activities while the others seem to look at total variety.

Can we conclude anything from this review of variability? I do not believe we can. The number of investigations is too few; they are spread over too many conceptualizations of variety; and in some cases the results are contradictory.

III. JUSTIFICATION FOR THE STUDY AND QUESTIONS

Several reasons speak to the usefulness of investigating the relation of variety to student attention. First, it is frequently held that they are related and yet the literature is very sparse and unclear on the subject. Secondly, the concept of variety of structures may add another dimension to those studies investigating patterns of classroom organization. Thirdly, some of the current interest in time-on-task is attempting to relate different types of instruction (e.g., direct vs. indirect) to student engagement. If it is the variety of structures which is related to attention rather than one type, it suggests that the search for the one best method is misguided.

To investigate this relation this study asks the following questions:

1. How much variety of structure does exist in the teaching of mathematics at the fifth grade level?
2. What is the relation between variety of structure and student time-on-task?
   a. Do classes with more variety have higher levels of attention?
   b. Do class-days with more variety have higher levels of attention?
   c. Within classes does the most popular format get less attention than a less frequently used format?

IV. METHODS AND DATA SOURCE

The 218 elementary school districts in the Chicago Standard Metropolitan Statistical Area were stratified by two expenditure levels (upper third and lower third) and three SES levels. From this stratification process eighteen districts were randomly selected and in the schools 36 classes were observed: 18 mathematics classes, 17 social studies classes, and one science class. This study only uses the data from the mathematics classes. Once the classes were chosen eight students from each classroom were randomly chosen for intensive classroom observations and parental interviews.

After a get-acquainted period in which observers and school acclimated to each other and during which a whole day's observation was made, the classes were observed for 6 to 10 days with a mean of over 8 days. This yielded data in math on 153 class-days over the 18 classes observed.

The data collecting process used two observers in a classroom, one writing an open narrative of the entire class' activities and the other taking 30-second time samples of the eight students, describing what they were doing and ascertaining whether given their behavior, they were on-task or off-task with regard to the class' ongoing activities. The narrative or activity structures were later segmented, using Gump's definition. Gump broke class periods into action subdivisions which had an internal integrity. He used the word "segment" to describe the subdivision. For instance, if after 15 minutes of recitation, the teacher announces that the class will now get ready to begin a contest between the two sides of the room, the class has gone from an instructional segment with a format of recitation to a transitional segment. When the contest begins, a new instructional segement has begun. In math there were 461 instructional segments over the 153 class days.

Once activity structures were segmented, each segment was coded for a series of ecological variables: teacher and student location, materials used, format of the activity, content of the material, student behavior, and length of the segments. Finally the individual observations of the eight students were meshed with the activity structures in which they "resided."

The most pertinent codes for this study were the segements themselves, specifically their number per day, the formats of the segments, and student behavior insofar as it indicated if the students were "on" or "off" task.

V. METHODOLOGICAL ISSUES

As the review of the literature indicates, there are many ways to conceptualize variety. In this study it was conceived as changes in "activity units" or segments within a class day. Variety was operationalized as more segments per day, more formats per day, and more total formats used over the entire observational period. Finally, less frequently used formats within a class were considered to offer more variety to those students compared to the format most used in that class.[1]

In a research project such as this in which enormous amounts of information are gathered and researchers later carve out portions of it to create the data for the questions they are posing, the methodological issues arise in defining and measuring variables. In this paper, there exist four issues over the definition and measurement of time, variety and attention. Each is described below.

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[1]Many aspects of variety were not examined in this paper. Perhaps the most important is variety within a segment. In this study a 25 minute seatwork segment may have involved nothing but adding or subtracting fractions or it might have involved that plus word problems plus a review of earlier material. Yet both would be considered one segment.

Time

The first decision was to analyze only instructional time, thus eliminating transitions and play. The dependent variable in this study is the extent of attention to class activities. During either play or transitional time, attention is not expected. Therefore, those times were not pertinent to this study. This is consistent with Kounin's idea that the variety which was of concern was the variety within the work rather than the existence of breaks from the work.

The second decision was to weight time by the number of students present in a segment rather than using only clock minutes. Thus 20 minutes of seatwork for two children would be counted as 40 student-minutes (the equivalent of Gump's "occupancy time") while 20 minutes of seatwork for 20 children would be counted as 400 student-minutes.

Percentages of instructional time in clock minutes and in student-minutes are identical when the class engages in whole class activities. However in classes which break up into groups, calculating percentages of instructional time in clock minutes grossly overestimates the importance of a segment if there are few children participating. A typical example is the percent of time that one class spent in group work. In actuality group work occurred only once during the time the class was observed and on that occasion two students worked together for 51 minutes. If percent of time is calculated by clock minutes, it would be 16.8% of overall instructional time vs. 3.4% using student-minutes. The student-minute measure of time is a better reflection of the relative importance of group work in that class.

Variety

Variety in the classroom may be conceived as the total amount of variety existing in the class as a whole or as a mean of the amount of variety which each student in the class personally experienced. Again, it is only when

a class breaks up into groups that the issue is raised.

An example in which the two measures would differ is as follows: A class begins with a 15-minute whole class recitation, then breaks up into 5 groups for 20 minutes of group work, and, finally, returns to the whole class format for another 10-minute recitation. Calculated on the whole class basis, there would be 7 different segments in that class. Calculated as the mean of what each student experienced, there would only be 3 segments. Furthermore, there were only 2 different formats that day--recitation and group work.

This study used the more conservative measure of variety. If variety of procedures affects student attention, I felt it was more meaningful to think of variety in terms of what the students experienced in their own behavior rather than what they picked up about the class "ambiance." Future research might reanalyze the data using the other measure of variety.

Attention

The fourth and last issue is whether to measure attention (percent "on") as all the observations coded "on" over total observations or whether to get a percent "on" for each child per segment or class and then get a mean of those percents for the attention measure. The former method was chosen for two reasons. First, taking a mean of each student's percent "on" gives equal weight to a student who was observed few times and one who was observed many times. For instance, a student observed twice and coded "on" both times would have a percent "on" of 100% while a student observed 9 times and coded "on" 7 of those times would have a percent "on" of only 78%. Second, taking means of percents reduces the richness of the data.

VI. RESULTS

A. How much variety of structure exists in the teaching of math in the fifth grade?

In a phrase, not very much. The mean number of instructional segments per day was 2.3 (sd = 1.1) and the mean number of differently-formatted instructional segments was somewhat less, 2.0 (sd = 0.87). The modal number of instructional segments per day and of differently-formatted instructional segments per day was 2.0 in both cases. (See Figure 1.)

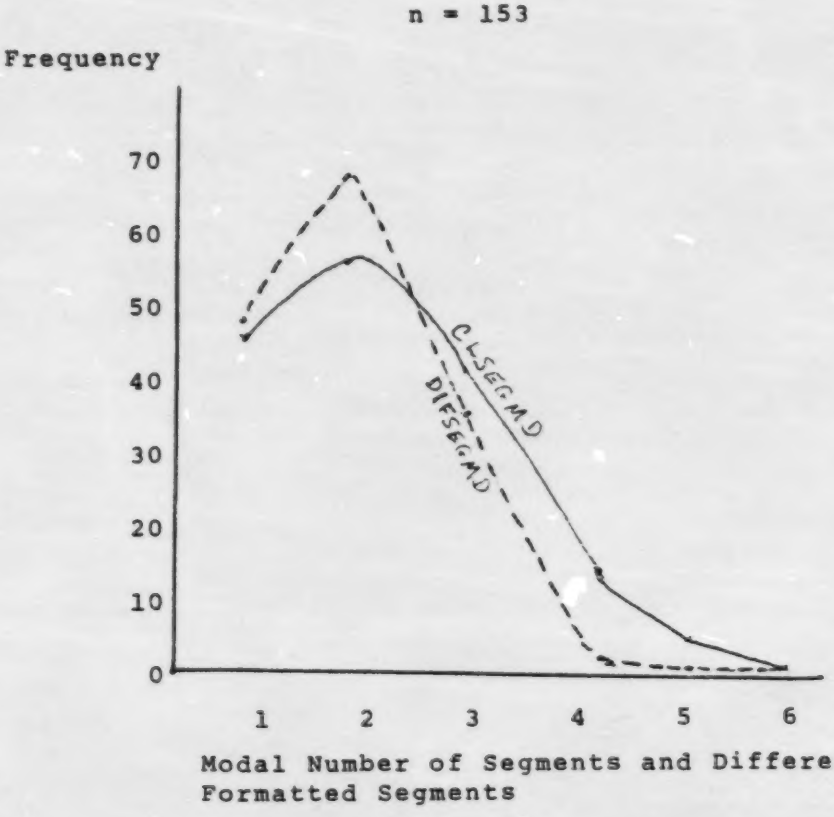

Figure 1 Frequency of Modal Number of Segments per Day (Clsegmd) and of Modal Number of Differently-Formatted Segments per Day (Difsegmd)

Another way of expressing the small number of instructional segments per day is to say that less than one-third of the 153 class-days observed had three or more instructional segments per day and only about one-fifth of the class-days observed had three or more differently-formatted segments in a day. (See Table 1.)

Table 1

Distribution of Mean Number of Segments Per Classday

n = 153

Mean no. of segments	Freq.	%	Cumulative percentage
1.0-1.9	46	30.1	30.1
2.0-2.9	58	37.9	68.0
3.0-3.9	32	20.9	88.9
4.0-4.9	11	7.2	96.1
5.0-5.9	5	3.2	99.3
6.0	1	0.7	100.0

Distribution of Mean Number of Differently-Formatted Segments per Classday

n = 153

Mean no. of diff-form. segments	Freq.	%	Cumulative percentage
1.0-1.9	54	35.3	35.3
2.0-2.9	67	43.8	79.1
3.0-3.9	24	17.0	96.1
4.0-4.9	3	1.9	98.0
5.0-5.9	2	1.3	99.3
6.0	1	0.7	100.0

Segments ranged in length from 1 to 63 minutes with a mean of 19.6 minutes (sd = 12.2) and took place in class periods which ranged in length from 11 to 82 minutes with a median of between 43 and 44 minutes.

If classes did not have many differently-formatted segments per class-day, how many did they use (of the 14 observed) in total? Over the entire observational period, which ranged from 6 to 10 days per class, classes used a total of anywhere from 2 to 9 instructional formats, with a mode of 4. (See Figure 2) These figures, however, misrepresent the amount of variety by overstating it. Some of the formats were used for only a tiny percent of instructional time in a class. Thus 9, or half of the 18 classes observed, had 85% or more of their instructional time in only 2 formats. None of the 18 classes used more than 5 formats to cover 85% of instructional time. (See Table 2)

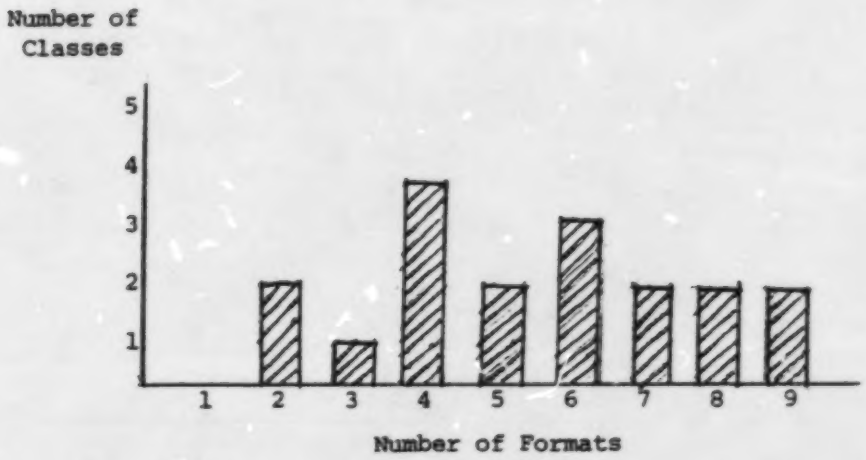

Figure 2 Total Number of Formats Used by Classes Over the Observational Period

TABLE 2

Distribution of Classes by the Number of Formats Required to Account for 50%, 75%, 85%, and 90% of Class Instructional Time

Number of Different Formats	Percent of Instructional Time Measured in Student Minutes			
	50%	75%	85%	90%
1	10	4	0	0
2	7	6	9	7
3	1	5	1	3
4		3	6	1
5			2	5
6				2

The most frequently used formats were seatwork and recitation. Seatwork in all its forms (seatwork, diverse seatwork, and individual seatwork) and recitation accounted for over 95% of student minutes in 5 of the 18 classes, for over 75% in 13 of the classes, and for over 50% in 17 of the 18 classes. (See Tables 3 and 4.)

TABLE 3

Percentage of Total Student-Minutes Instructional Formats Were Used in Fifth-Grade Math Classes

Rank	Format Name	Percentage
1	Seatwork	39.5%
2	Recitation	35.2
3	Individual Seatwork	14.8
4	Contest	3.5
5	Check Homework or Test	2.9
6	Test	1.6
7	Diverse Seatwork	1.3
8	Giving Instruction	0.4
9	Lecture	0.2
10	Tutoring	0.2
11	Discussion	0.1
12	Group Work	0.1
13	Preparation	0.07
14	Demonstration	0.04
	Total	99.91

TABLE 4

Percent of Instructional Time Seatwork (in all its forms) and Recitation Make Up of Instructional Time

Class I.D.	Percentage
311	98.9%
111	98.5
911	96.7
913	96.3
621	95.5
413	88.3
313	87.9
811	79.8
513	79.5
411	78.9
813	77.6
721	77.2
611	76.7
631	74.1
711	72.2
511	56.7
211	52.0
213	30.1

Whatever variety in terms of number of instructional segments and number of differently-formatted instructional segments a class had per day was shared by nearly the entire class. 93.7% of the children observed experienced the same number of segments as the class mode and 95.8% experienced the same number of formats as the class mode. Indeed, these figures slightly underestimate the uniformity within a class because some of the cases in which students experienced fewer segments than the class mode occurred because the observed child left the class before the end of the period.

In conclusion, student time in most classes was spent in recitation and/or some form of seatwork. Students averaged just over two instructional segments per day and two different formats per day with only 13% of class-days having more than three instructional segments and only 6% having over three different formats. Whatever variation one child in a class experienced, the rest of the children in that class were almost certain to experience the same amount.

Are there any intervening variables which might help explain the differences which do exist between classes on the amount of variety in structure which they provide their students? Length of class period correlates positively and significantly with both mean number of segments per class-day (rho = 0.33, $p < .0001$) and mean number of differently-formatted segments (rho = 0.22, $p < .006$). While both are highly significant, the size of the correlation suggests that length of period is not the only factor affecting instructional variety.

The number of segments per day and the number of different formats used over the observational period are affected to some extent by the characteristics of the larger community. Tables 5 and 6 show the number of segments experienced per day and the number of formats required to

account for 75% of instructional time by socioeconomic status (SES) and school expenditure level. The low expenditure, high SES cell is empty because it is very difficult to find an upper SES community which will tolerate low levels of expenditure on education.

TABLE 5

Mean Number of Segments Students Experienced per Class-Day by SES and Expenditure Level

n = 153

Expenditure Level	SES Low	SES Middle	SES High	
Low	$\bar{x}$ = 2.66 sd = 0.98 (25)	$\bar{x}$ = 2.74 sd = 1.04 (37)		$\bar{x}$ = 2.71 (62)
High	$\bar{x}$ = 2.20 sd = =.70 (29)	$\bar{x}$ = 2.07 sd = 0.80 (36)	$\bar{x}$ = 1.54 sd = 0.71 (26)	$\bar{x}$ = 1.96 (91)
	$\bar{x}$ = 2.41 (54)	$\bar{x}$ = 2.41 (73)	$\bar{x}$ = 1.54 (26)	$\bar{x}$ = 2.26 (153)

TABLE 5A

ANOVA Table of SES and Expenditure Effects on Mean Number of Segments per Class-Day

Source	DF	Type IV SS[2]	F Value	PR>F
SES	2	0.073	10.96	0.0001
Expenditure	1	0.011	3.40	0.672
SES*Expenditure	1	0.028	8.39	0.0044

2 All Anova tables in this paper use Type IV SS as calculated by SAS. They are calculated as though that variable were the last added in the model. "The F and PR>F values are equivalent to the result of a T test for testing the hypothesis that the regression parameter equals 0." (SAS User's Guide, 1979, p. 239)

An analysis of variance of Table 5 (Table 5A) shows that SES, expenditure, and their interaction are all related to mean number of segments per day with expenditure being only marginally significant. All of these effects, I believe, are an artifact of the way I measured variety. In high expenditure middle and high SES cells there were two classes each which had over 50% of their instructional time in individual seatwork. If one considers this from the point of view of what the individual student experiences, as I did, it counts as only one segment over the class period. But if we consider that each student is (or may be) engaged in a different content area, then the amount of variety will take a staggering jump upwards. Measured that way variety would increase with SES and with expenditure levels instead of declining as it does. Table 5 indicates that the strong SES effect comes from the difference between middle and high SES.

TABLE 6

Mean Number of Formats per Class Required to Account for 75% of Instructional Time by SES and School Expenditure Level

n = 18

Expenditure Level	SES Low	Middle	High	
Low	$\bar{x}$ = 2 (3)	$\bar{x}$ = 3 (4)		$\bar{x}$ = 2.57 (7)
High	$\bar{x}$ = 3 (3)	$\bar{x}$ = 1.5 (4)	$\bar{x}$ = 2.5 (4)	$\bar{x}$ = 2.27 (11)
	$\bar{x}$ = 2.5 (6)	$\bar{x}$ = 2.25 (8)	$\bar{x}$ = 2.5 (4)	$\bar{x}$ = 2.39 (18)

TABLE 6A

Anova Table of SES and Expenditure Effects on Number of Instructional Formats Used to Account for 75% of Instructional Time

Source	DF	Type IV SS	F Value	PR F
SES	2	4.182	2.27	0.14
Expenditure	1	0.214	0.23	0.64
SES*Expenditure	1	5.357	5.80	0.03

Neither SES nor expenditure level had a significant effect on the number of different formats a class used over the observational period. However, there is an interaction at a significance of .03. (See Tables 6 and 6A) The reason for this interaction lies in the difference in high and low expenditure levels in the middle SES cells. In the high expenditure cell two of the four classes use individual seatwork and one uses seatwork very heavily. In those classes students worked for long periods on their own, checking with the teacher periodically. In the low expenditure cell the classes were primarily united as a whole class with the teacher leading them and taking the students through a number of different formats.

B. What effect does variety have on student attention?

To answer this question, I undertook three analyses of the effect of number of segments per day on student attention. The first approach was a between classes comparison of attention levels based on the mean number of segments the classes had per day. I compared the attention of the 8 classes with the greatest mean number of segments per day with the 8 classes with the fewest mean number of segments per day. (The two middle classes had identical mean number of segments per day.) The means ranged from 2.3 to 3.7 segments per day for the top 8 and from 1.0 to 2.0 for the bottom 8. I further compared attention in the top and bottom third of the classes (6 each). The top third had a mean number of segments ranging from 2.6 to 3.7 and the bottom third ranged from 1.0 to 1.7. Lastly, I compared the 3 classes which had a mean of over 3.0 segments per day with the 4 classes which had a mean of fewer than 1.5 segments per day. The results of the t-tests comparing these groups showed the differences to be insignificant. (See Table 7)

TABLE 7

A Comparison of Attention Levels in Classes with Different Numbers of Instructional Segments per Day

	Mean percent "on" of the 8 classes with the highest number of segments per day vs. the 8 classes with the fewest number of segments per day	Mean percent "on" of the 6 classes (top 1/3) with the most segments per day vs. the 6 classes (bottom 1/3) with the fewest number of segments per day	Mean percent "on" of the three classes with a mean of more than 3 segments per day vs. the 4 classes with a mean of fewer than 1.5 segments per day
Mean Percent "on"	$\bar{x}$=0.789 sd=.066 (top 8) $\bar{x}$=0.766 sd=.070 (bottom 8)	$\bar{x}$=0.809 sd=.059 (top 1/3) $\bar{x}$=0.775 sd=.070 (bottom 1/3)	$\bar{x}$=0.762 sd=.041 (top 3) $\bar{x}$=0.807 sd=.059) (bottom 4)
t value	t = .685	t = .910	t = -1.2 t = -1.1
significance	n.s.	n.s.	n.s.

A second analysis was made comparing attention on the 153 class-days by the number of segments per day, but this time controlling for the length of period. (See Table 8) The resulting analysis of variance (Table 8A) indicates that mean number of segments and length of period have no significant relation to attention but the interaction of the two is significant at the p .025 level. The distribution of levels of attention in Table 8 suggests that a greater number of segments, or more variety, only raises attention levels if class periods are longer. In shorter class periods an increase in number of segments per day is associated with a reduction in levels of attention.

The most plausible explanation for this comes from Gump's finding that start-up and ending times in a segment have lower attention levels than the middles of segments. If there are too many segments, it means a greater

proportion of class time is devoted to start-ups and endings. This applies to the beginnings and endings of class periods as well. Shorter periods with more segments will also have more segments of 10 minutes or less. In this study these segments have the lowest levels of attention in math and 69% of them occur as the first or last instructional segment of the class period.

TABLE 8

Attention as Mean Percent "On" in Class-Days with Different Mean Number of Segments, Controlling for Length of Period

n = 152*

Mean No. of Segments per Class-Day	Length of Period in Minutes 11 - 41 n=51	42 - 45 n=49	46 - 62 n=52	
1.0 - 1.9	$\bar{x}$ = 0.799	$\bar{x}$ = 0.752	$\bar{x}$ = 0.735	$\bar{x}$ = 0.787
n=45	sd = .071 (22)	sd = .134 (16)	sd = .132 (7)	
2.0 - 2.9	$\bar{x}$ = 0.799	$\bar{x}$ = 0.755	$\bar{x}$ = 0.755	$\bar{x}$ = 0.778
n=58	sd = .118 (23)	sd = .094 (18)	sd = .112 (17)	
3.0 - 6.0	$\bar{x}$ = 0.697	x = 0.832	$\bar{x}$ = 0.782	$\bar{x}$ = 0.767
n=49	sd = .103 (6)	sd = .062 (15)	sd = .091 (28)	
	$\bar{x}$ = 0.773	$\bar{x}$ = 0.772	$\bar{x}$ = 0.787	$\bar{x}$ = 0.777

*For one day there was no data for attention level.

TABLE 8A
Anova Table of the Effect of Number of Segments Per Day and Length of Period on Student Attention

Source	DF	Type IV SS	F Value	PR > F
Length of period	2	0.011	0.55	0.578
Number of segments	2	0.002	0.07	0.928
Length of period * Number of Segments	4	0.118	2.87	0.025

Finally, in 14 of the 18 classes I was able to do a within-class comparison of attention on days in which the classes had had more segments with days in which they had had fewer segments. For one class that might be 4 days with 3.0 or fewer segments and 5 days with 4.0 or more segments and for another class it might be 4 days with 1.0 segments and 2 days with 3.0 or more segments per day. In several cases I ignored class-days in the center and compared only the extremes. In each case, however, the categories of more and fewer segments were separated by at least one segment per day and in 4 classes, it was by more than that.

This method of comparison yielded information on 104 of the 153 class-days. Since the observations were made on the same children, I assumed the observations were not independent and used a matched pair model of the t test. The t was -1.99, significant at 0.068. The finding indicates that within a class, when the pace seems more brisk, attention is heightened. However, it must be remembered that the between-class comparison showed than in shorter periods an increase in number of segments per day to 3 or more produced a decrease in attention.

One other question presented itself. Since SES alone and also in interaction with level of expenditure was associated with mean number of segments per day, was SES, alone or interacting with level of expenditure, confounding the relation between attention and mean number of segments per day when length of period was controlled?

To establish if this were the case, I first displayed the distribution of length of period by SES and expenditure level. (Table 9) Neither SES, level of expenditure, nor their interaction has any bearing on length of period. (See Table 9A.)

TABLE 9

Length of Class Periods in Minutes with Means of Each Class by SES and Expenditure Levels

n = 18

Expenditure Level	SES Low n=6	Middle n=8	High n=4	
Low n = 7	50.9 49.6 $\bar{x}$=49.9 49.2 sd=.89	42.9 42.0 $\bar{x}$=45.7 41.6 sd=7.15 56.4		$\bar{x}$ = 47.5
High n = 11	46.1 44.1 $\bar{x}$=40.2 30.4 sd=8.55	36.8 39.9 $\bar{x}$=42.9 42.1 sd=6.95 52.8	35.6 39.7 $\bar{x}$=45.8 41.0 sd=14.3 67.0	$\bar{x}$ = 43.2
	$\bar{x}$ = 45.1	$\bar{x}$ = 44.3	$\bar{x}$ = 45.8	$\bar{x}$ = 44.9

TABLE 9A
Anova Table of the Effect of SES and Level of Expenditure on Length of Period

Source	DF	Type IV SS	F Value	PR>F
SES	2	54.914	0.34	0.72
Expenditure Level	1	132.326	1.62	0.23
SES * Expenditure Level	1	41.700	0.51	0.49

To examine the relation of attention to SES and expenditure level, I drew up two tables: attention for all class-days by SES and expenditure level (Table 10) and attention for the 37 class-days with the least variety, a mean of less than 1.5 segments per day, by SES and expenditure level (Table 11) with analysis of variance tables accompanying each of them.

The tables show a relation between attention and SES and expenditure level but not one which confounds the relation of number of segments per day and attention. Looking back to Table 5 we see that mean number of segments per day dropped in the high expenditure level as SES increased. Attention, however, shows a curvilinear relation to SES in the high expenditure level. (Table 10) The effect is heightened if we look at days with very few segments in them (Table 11).

TABLE 10

Attention as Mean Percent "On" Over All Class-Days
by SES and Expenditure Levels
n = 152*

Expenditure Level	SES Low n=54	SES Middle n=73	SES High n=25	
Low n=62	$\bar{x}$ = 0.802 sd = .097 (25)	$\bar{x}$ = 0.786 sd = .098 (37)		$\bar{x}$ = 0.793
High n=90	$\bar{x}$ = 0.747 sd = .091 (29)	$\bar{x}$ = 0.799 sd = .095 (36)	$\bar{x}$ = 0.742 sd = .129 (25)	$\bar{x}$ = 0.766
	$\bar{x}$ = 0.772	$\bar{x}$ = 0.793	$\bar{x}$ = 0.742	$\bar{x}$ = 0.777

*For 1 day there was no data on attention level.

TABLE 10A

Anova Table of SES and Expenditure Level Effects
on Attention over All Class-Days

Source	DF	Type IV SS	F Value	PR>F
SES	2	0.065	3.14	0.05
Expenditure Level	1	0.014	1.34	0.25
SES-* Expenditure Level	1	0.036	3.45	0.07

TABLE 11

Attention as Mean Percent "On" for Class-Days on which There Was a Mean of Fewer Than 1.5 Segments per Day by SES and Expenditure Levels

n = 37

Expenditure Level	SES Low n=7	SES Middle n=18	SES High n=12	
Low n=4	$\bar{x}$ = 0.722 sd = .040 (2)	$\bar{x}$ = 0.712 sd = .223 (2)		$\bar{x}$ = 0.717
High n=32	$\bar{x}$ = 0.729 sd = .041 (5)	$\bar{x}$ = 0.847 sd = .062 (16)	$\bar{x}$ = 0.700 sd = .067 (12)*	$\bar{x}$ = 0.778
	$\bar{x}$ = 0.727	$\bar{x}$ = 0.832	$\bar{x}$ = 0.700	$\bar{x}$ = 0.771

*For one day there was no data for attention level.

TABLE 11A
Anova Table of SES and Expenditure Level Effects
on Days with a Mean of Fewer Than 1.5 Segments per Day

Source	DF	Type IV SS	F Value	PR F
SES	2	0.156	19.91	0.0001
Expenditure Level	1	0.016	3.05	0.091
SES * Expenditure Level	1	0.013	2.51	0.123

On those class-days with the fewest number of segments per day attention drops in every cell except the middle SES high expenditure cell. The notably high attention level in that cell is produced entirely by two classes taught by the same teacher in one school. They are the only two classes represented in that cell in Table 11. The school used only two formats--individual seatwork and contests. Its attention levels in individual seatwork were higher than in any of the other six schools which used it. Its attention levels in the contest format were higher than in all but two of the other six schools which used it and in one of those two schools there were only six observations made in the contest format. Thus higher attention levels in that cell seem to be a function of that particular school and its curriculum rather than a direct SES or expenditure level effect.[3] Therefore I believe we can conclude that the relation between the mean number of segments per day and attention levels is not confounded by SES or expenditure levels or their interaction.

As a next step in analyzing the data I explored whether number of formats used over the observational period had any impact on student attention.

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[3]Of course, we do not know whether that teacher and curriculum could be moved into a low expenditure, low SES school district and operate with the same attention levels. It might not occur; nevertheless, the notably higher attention levels seem to reflect that school rather than the cell as a whole.

TABLE 12

A Comparison of Attention Levels in Classes which Used a Different Number of Formats over the Observational Period

	Classes which spent 50% or more time in one format vs. Classes which had ∠50% of student time in any format	Classes which spent 75% of instructional time in 1 or 2 formats vs. Classes which spent 75% of instructional time in 3 or 4 formats	Classes with 2 formats accounting for 90% of instructional time vs. Classes with 5 or 6 formats accounting for 90% of instructional time	Classes in which recitation and seatwork take up 90% of instructional time vs. Classes in which recitation and seatwork take up 75% of instructional time
Percent "on"	0.772 sd=.07 n=10	0.788 sd=.07 n=10	0.769 sd=.07 n=7	0.738 sd=.06 n=5
	0.773 sd=.07 n=8	0.753 sd=.05 n=8	0.762 sd=.05 n=7	0.762 sd=.05 n=5
t value significance	-.04 ns	1.21 between .05 & .10	.223 ns	-.68 ns

To that end I compared attention levels in the following groups of classes:

10 classes with 50% or more time spent in one format	vs.	8 classes with less than 50% of instructional time in any one format
10 classes with 75% of instructional time in 1 or 2 formats	vs.	8 classes which used 3 or more formats to account for 75% of instructional time
7 classes in which 2 formats account for 90% of instructional time	vs.	7 classes in which 5 or 6 formats account for 90% of instructional time
5 classes in which recitation and seatwork take up 90% of instructional time	vs.	5 classes in which recitation and seatwork take up less than 75% of instructional time

The only t test which is marginally significant suggests that less rather than more variety in format produces higher attention, but the significance is so low and the direction of the relationship does not follow in each comparison that I believe it is better interpreted as chance. (See Table 12)

Another way of looking at variety is to make intraclass comparisons across classes of the most frequently used format with a less frequently used one. Since classes in the study differed in the amount of time they allotted to each format, I needed to find a manner of comparing them which included as many classes as possible. The method I used compared the most frequently used format with the next most frequently used format as long as the latter was used at least 15% fewer student minutes than the most "popular" one. Using this method I was able to make intraclass comparisons in 11 of the 18 classes. Mean percent "on" for the most frequently used formats was 0.754 (sd = .07) and for the next most frequently used formats it was 0.834 (sd = .07). Using a matched pairs t test the t was -2.97 with a p value of .01. This suggests that the most frequently used format may produce some boredom in a class just because of its frequency and not because of anything inherent in the format itself.

To check if this difference was the result of formats with higher attention levels being used with disproportionate frequency in the next most used category, I calculated the mean attention levels of each group of formats, weighted by their frequency, in the most used and next most used categories and the resulting t (-1.25) was not significant. Furthermore, higher attention levels for the next most used formats or for the same formats when they are used as the second most popular format are pervasive in the data. See Table 13.

TABLE 13

Mean Attention Levels for Most Used and Next Most Used Formats and for Recitation and Seatwork When Used as Most Used and Next Most Used Formats

	Percent Instructional Time Calculated Using Student Minutes		Percent Instructional Time Calculated Using Clock Minutes	
	Most Used	Next Most Used	Most Used	Next Most Used
Top 2 formats in 11 classes in which 15% or more time separates them	$\bar{x}$=0.754 sd=.072	$\bar{x}$=0.834 sd=.074	$\bar{x}$=0.751 sd=.075	$\bar{x}$=0.826 sd=.076
Top 2 formats in 7 classes in which less than 15% time separates them	$\bar{x}$=0.762 sd=.080	$\bar{x}$=0.792 sd=.060	$\bar{x}$=0.781 sd=.139	$\bar{x}$=0.780 sd=.079
Recitation	$\bar{x}$=0.736 sd=.041	$\bar{x}$=0.811 sd=.064	$\bar{x}$=0.766 sd=.073	$\bar{x}$=0.780 sd=.067
Seatwork	$\bar{x}$=0.803 sd=.080	$\bar{x}$=0.797 sd=.037	$\bar{x}$=0.805 sd=.103	$\bar{x}$=0.842 sd=.044

Comparing the most used format with the ones used extremely infrequently does not show the same relation. The infrequent formats exhibit tremendous amounts of variation in attention and do not have higher levels of attention on the average than the most used formats.

VI. CONCLUSIONS

My conclusion is that in teaching a skill-oriented course to fifth grade children variety of instructional procedures is not a very important variable in accounting for student attention. Second, insofar as variety of procedure does affect student attention, greater variety enhances attention only if there is sufficient time in the class period to allow for more segments. If there is not, it detracts from attention. In a longer period having a mean of 3 or more segments per period produces a modest increase in attention levels.

What explains the prevailing opinion, then, that variety is key to producing higher levels of attention? Two of the findings of this study offer a partial explanation: one is that on days with more changes of pace children show more attention than when there are fewer such changes and, secondly, there seems to be a satiation factor with the most frequently used format compared to the next most frequently used one. A teacher may very well be sensitive to these intraclass changes in attention and deduce that more variety produces more attention.

A second possibility is that we were measuring the wrong kind of variety. The research which showed a positive relation between variety and achievement spoke of many other kinds of variety. Perhaps variety within segments or some other kind of variety is the important variable.

A third possibility is that variety in instructional procedures, as we defined it, has an effect on attention but one which we were not measuring. Perhaps it produces more intense attention. This study makes no distinction between being lackadaisically "on" and being enthusiastically "on" although it might be possible to code that in some of the records. Nor do we have

data on student enjoyment of a subject. It is possible that the folklore about variety picks up the fact that students seem to be having a better time when the fare is more varied and this is interpreted by the teacher as an increase in attention.

Finally, it is possible that the folklore and research findings supporting the positive relation between variety and attention are wrong. If that is the case, I believe it would be interesting to direct future research to explore Kounin's idea that in a skills course "felt progress in learning" is a more important anti-satiation factor for older children than is experienced variety.

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